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**Evaluation of Redbreast Sunfish Stockings
in
Kentucky Streams**

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Evaluation of Redbreast Sunfish Stockings
In Kentucky Streams

by

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ABSTRACT

Northwestern Fishery District

A total of 97,500 fingerling redbreast sunfish (Lepomis auritus) were stocked at two locations on Cypress Creek during 1979-1981. Cypress Creek, a tributary of Pond River, is located in Muhlenburg and McLean counties. This stream was selected for redbreast sunfish introduction due to its historical degradation by acid-mine waters. Redbreast sunfish supposedly tolerate low pH waters better than our native sunfish species (Jones 1979). Subsequent fish population studies, by chemical (fish toxicant) and hook-and-line methods, produced no redbreast sunfish. Cursory creel surveys and discussions with local conservation officers revealed no known harvest of redbreast sunfish at either of two stocking locations. Improvements in water quality (particularly pH) occurred prior to and during the stocking period as a result of mine closings and reclamation activities in the watershed. Good populations of black bass and panfish species are present in the stream as revealed by subsequent population studies. The combination of improved water quality and concomitant natural fish population expansion prevented the establishment of redbreast sunfish. Fortunately, improvements in water quality allowed natural fish populations to improve and provide excellent fishing opportunities, far in excess of what would have been provided by redbreast sunfish.

Southeastern Fishery District

Redbreast sunfish were stocked into selected streams of the

upper Cumberland River drainage in an attempt to establish fishable populations of this species. Fish population, water quality, and age-growth studies were conducted during 1977-1984 in order to determine the success of this stocking program. A fishable population of redbreast sunfish existed in Jellico Creek (Whitley County) in 1980, as redbreast were taken at a catch rate of 8.0 fish per hour of electrofishing. In 1978, redbreast sunfish represented 13.3 percent of the fish population and 55 percent of the harvestable-size fish taken in Straight Creek (Bell County). The catch rate by electrofishing was 36 redbreast sunfish per hour. Redbreast sunfish represented 56 percent of the fish population in Indian Creek (McCreary County) during 1980 and the catch rate averaged 14 redbreast per hour of electrofishing. Studies during 1984 revealed that redbreast sunfish made up 13 percent of the fish population at Watts Creek (Whitley County). Cursory creel surveys indicated that a significant part of the creel was made up of redbreast sunfish. Studies on Clear Fork (Whitley County) showed that a population of redbreast sunfish had not become established by 1983. Age and growth studies indicated that redbreast sunfish reached harvestable size (6 inches) at age 4 or 5. The physical-chemical characteristics of all streams stocked with redbreast sunfish were well within established criteria for suitable redbreast sunfish habitat. There are now seven streams in Kentucky with an established population of redbreast sunfish.

Eastern Fishery District

Redbreast sunfish were stocked for 3 consecutive years in Greasy Creek, located in eastern Kentucky in Leslie County. A total of 170,820 2-inch fish were stocked in the mid-section of the stream.

Greasy Creek has been impacted by deep-mine operations since the early 1970's; before then, this stream was considered a high quality stream (Jones 1973). A total of 1.5 hours of diurnal electrofishing was conducted in 1984 in three pools in order to determine if a population of redbreast sunfish had established. Electrofishing studies and angler interviews did not indicate that this species had become established. Reasons for their failure were attributed to high turbidity and a high sediment load on the stream bed. The mean depth of sediment not compacted on the stream bottom was 0.3 ft.

Northwestern Fishery District

Cypress Creek, a tributary to Pond River, has had a history of acid-mine degradation. Redbreast sunfish (Lepomis auritus) were recommended for stocking due to their successful stockings in other similarly degraded watersheds in Kentucky (Jones 1979). Cypress Creek contained viable, although suppressed, fish populations prior to stocking as evidenced by periodic fish kills in portions of the watershed from acute acid-mine releases. These fish populations were composed primarily of panfish species, bowfin, and carp. Redbreast sunfish were introduced into Cypress Creek in an effort to establish a fishable population of this acid-tolerant fish and thus bolster the low standing crop of native species.

Southeastern Fishery District

Redbreast sunfish were recommended for stocking in a few streams in the upper Cumberland River drainage, based on information obtained from studies on streams in the drainage by Carter and Jones (1969). Many of the streams in this drainage have been degraded by coal mining activities for several years.

Redbreast sunfish tolerate much lower pH values than do native sunfish according to Shannon (1966). Other physical-chemical requirements for redbreast sunfish are similar to that required for other Lepomis species. Redbreast sunfish prefer a substrate mixture of sand and gravel for spawning (Phillips 1968); males begin nest construction when water temperatures range between 70-75 F and peak spawning activity occurs when water temperatures range between 80 and 86 F (Phillips and Shannon 1967).

Fishable populations of redbreast sunfish were successfully established in Brownies, Clear, and Marsh creeks, the first streams in Kentucky to be selected for redbreast introductions in 1969 (Jones 1979). Jellico Creek (Whitley County) and Straight Creek (Bell County) were the first of five additional streams to be initially stocked with redbreast sunfish in 1974. Subsequently, redbreast sunfish were initially stocked in Indian Creek (McCreary County), Watts Creek (Whitley County), and Clear Fork (Whitley County) in 1976, 1977, and 1979, respectively. Studies designed to evaluate the success of the redbreast sunfish introductions were initiated on each stream 3 years after the initial stockings.

Eastern Fishery District

Greasy Creek, located in Leslie County, was chosen as an experimental stocking site for redbreast sunfish in eastern Kentucky. The stream is located in the eastern coal field region, characterized by steep hills and narrow valleys typical of the Appalachian mountain chain. Greasy Creek rises in Harlan County and flows northwestward to join the Middle Fork of the Kentucky River near Hoskinston. This order IV stream has a mean gradient of 64.9 ft/mi and is best described as a series of riffles and pools having a ratio of about 50-50. The stream is characterized as having medium fish cover consisting primarily of boulders, a 20-30 m riparian zone, 0-5% shade, and a bottom type composed of bedrock, boulder, rubble, gravel, sand, and silt. Total stream length is 27.3 mi. Two fish population studies, one in the late 1950's (Turner 1959) and the other in the early 1970's (Jones 1973), indicated high quality stream conditions. Degradation of the stream and its drainage began in the early 1970's that involved deep

mining, timber harvesting, and residential development.

Prior to increased mining activities, fishing was considered good to fair. Species sought included smallmouth bass (Micropterus dolomieu), panfish, channel catfish (Ictalurus punctatus), and rainbow trout (Salmo gairdneri), a species that was stocked on a put-and-take basis by the Kentucky Department of Fish and Wildlife Resources. Increased siltation necessitated the suspension of the trout stocking in the early 1980's. Silt also impeded smallmouth bass and channel catfish populations as well. It probably accounted for the overall decrease in biomass and standing crop of all fish species in the stream.

Redbreast sunfish are found from Maine to Florida. This species flourishes in a wide range of ecological conditions from headwater streams to coastal-plain rivers and lakes, from elevations of 3,500 ft to lowland waters, and in water with pH ranges of 4.8 to 8.4. They may also be found in trout waters (Carlander, 1977). The stocking of redbreast sunfish was considered due to its tolerance to lower pH levels. It was hoped that this fish would provide increased fishing opportunities in a stream where game and panfish numbers had diminished.

METHODS

Northwestern Fishery District

A total of 97,500 fingerling (1-2 in) redbreast sunfish were stocked at two locations on Cypress Creek in Muhlenburg County, Kentucky. The sites were selected due to their accessibility by fishermen and fish-hauling trucks. The initial stocking of 45,000

redbreast fingerlings was made in October 1979, and subsequent stockings were made the following 2 years, with 12,500 fingerlings being stocked in 1980 and 40,000 in 1981.

Pertinent physical, biological, and chemical data was collected from Cypress Creek in order to determine the relative success of redbreast stockings.

Chemical Characteristics

The following chemical characteristics were determined at Cypress Creek: pH - using a portable battery-powered meter, and total alkalinity - using bromcresol green-methyl red as the indicator and titrating with 0.02N sulfuric acid.

Physical Characteristics

The following physical characteristics were determined at Cypress Creek at the most upstream stocking site: water temperature - taken with a pocket-type mercury thermometer, stream flow - using procedures and formula given by Emobdy 1927, stream transparency - measured with a secchi disk, gradient, average width, average depth, bottom type, shade cover, and observations on the abundance of fish shelter and aquatic vegetation.

Biological Characteristics

Fish population sampling was conducted with emulsifiable rotenone and hook-and-line. Efforts to electrofish Cypress Creek with an electrofishing boat were abandoned due to obstructions in the form of log jams, beaver dams, and impassable riffle areas. Efforts to use a backpack shocker were also abandoned due to persistent equipment malfunction and repair delays. Project personnel conducted cursory

creel surveys and interviewed local conservation officers regarding their observations of the creel.

Emulsifiable rotenone (1.0 ppm of 5% emulsifiable) was applied to a section of the stream that was partitioned off with small-mesh block nets. Potassium permanganate was used to detoxify the rotenone and eliminate a downstream fish kill. Fishes were recovered with dip nets and fishes were sorted into fingerling, intermediate, and harvestable-sized groups. Those fishes that could not be identified in the field were preserved with 10% formalin and subsequently identified in the laboratory.

Hook-and-line samples consisted of 18 man-hours of fishing with light spinning tackle equipped with small (#6) hooks, floats, and live crickets for bait. Hook-and-line samples were conducted only at the upper stocking site due to problems that developed at the lower stocking site regarding fisherman access. The landowner in this area posted his ground and denied fishermen access to the creek during the term of this study. This was more the result of vandalism and "partying" in the area than fisherman usage; however, fishing subsequently ceased in this stream section as did our research.

Southeastern Fishery District

Pertinent physical, biological, and chemical data were collected from streams in the upper Cumberland River drainage, that have been stocked with redbreast sunfish, in order to determine the relative success of these introductions.

Chemical Characteristics

The following chemical characteristics were determined at

each sampling site: dissolved oxygen (Yellow Springs Model 54 oxygen meter), total alkalinity (brom-cresol green-methyl red as the indicator and titration with 0.02N sulfuric acid), and pH (portable battery-powered meter). In 1982, salinity and specific conductivity were measured by the use of a YSI Model 33 S-C-T meter.

Physical Characteristics

The following physical characteristics were determined at each study site. Stream transparency was measured in inches with a secchi disk from the inception of the studies through 1982. During 1983-1984, a turbidity meter was used to measure turbidity. The surface water temperature and air temperature were recorded with a pocket-type alcohol thermometer or a YSI oxygen meter.

Biological Characteristics

The following biological characteristics were recorded at each sampling site: fish population composition and dominant forms of aquatic vegetation, and macrobenthic organisms that were recorded by inspecting the riffles and listing the dominate forms observed.

Fish population sampling was done with a 220-volt A.C. backpack electrofishing unit or a whip-type electrode powered by a portable Homelite 1,500 watt, 160 cycle, single phase, 120 volt generator. Fish were recovered with dip nets, and the easily-identified species were then sorted into inch groups at the site. Small fish, as well as unidentified specimens, were preserved in 10% formalin and subsequently identified in the laboratory.

Project personnel conducted cursory creel surveys whenever they were in those areas where redbreast sunfish had been stocked. Department conservation officers were interviewed concerning their

knowledge of any redbreast sunfish having been caught. In addition, project personnel fished with rod and reel in order to determine the fishability of the redbreast sunfish population in selected streams.

Age and Growth Determinations

Scale samples were collected from redbreast sunfish taken from study streams. Scales were removed from below the lateral line just beyond the tip of the pectoral fin. Scales were cleaned and mounted between glass slides and projected by a Tri-simplex microprojector (Bausch and Lomb) with a 12X objective. Back calculations of growth were determined by utilizing a modification of the Lee method (Lagler 1956, Everhart and Youngs 1981), using a correction factor determined from the body-scale relationship by least square regression using the following equation by Michaels et al. (1981):

$$L_t = MST + C \text{ where:}$$

L_t = total length of fish

M = slope

S^t = scale radius

C = intercept

The correction factor was used in the formula $L' = C + \frac{S'}{S}(L-C)$ where:

L' = length of fish at formation of annulus

C = correction factor

S' = length of scale at annulus

S = length of total scale radius

L = total length of fish at capture

Eastern Fishery District

A total of 170,820 redbreast sunfish, averaging 2 inches in length, were stocked over a 3-year period in Greasy Creek. Stocking was initiated in 1979 with 43,320 fish being stocked and 12,500 were stocked in 1980 and 115,000 in 1981. The stocking site was located in the mid-section of the stream, about 14 miles from the mouth.

Study sites were located where terrain permitted access. A total of three pools were sampled. Sampling was done by means of a 16-foot aluminum electrofishing boat equipped with a 5,000 watt Homelite alternator with a Chenault booster. After an adequate fish sample was obtained, fish were identified, measured, and released.

Physical characteristics of the stream were observed by direct observation or measurement by yardstick or measuring tape. Chemical characteristics of the stream were measured by various meters or tests. Air and water temperature were measured by a hand-held mercury thermometer; dissolved oxygen, salinity, and conductivity were measured by a Yellow Springs Instruments meter. Alkalinity and pH were determined by Hach field kits. Turbidity was determined with a colorimeter.

RESULTS

Northwestern Fishery District

Cypress Creek

Physical and chemical characteristics of the upper stocking site of Cypress Creek are given in Table 1. Also included is the fish fauna collected on 18 July 1980 as a result of a rotenone survey conducted at this site. A diverse fish assemblage was present; however, no redbreast sunfish were collected on this date. Subsequent hook-and-line sampling in June of 1983 resulted in the creeling of numerous large bluegill (Lepomis macrochirus), warmouth (Lepomis gulosus) and longear sunfish (Lepomis megalotis). Lesser numbers of white crappie (Pomoxis annularis), largemouth bass (Micropterus salmoides), redear sunfish (Lepomis microlophus), and a single bowfin (Amia calva) were also taken. No redbreast sunfish were taken or observed.

Conversations with local conservation officers revealed no known harvest of redbreast sunfish.

Southeastern Fishery District

Jellico Creek

Redbreast sunfish were stocked in Jellico Creek in 1974-1976 (Table 2). In 1969, 250 1-4 in redbreast sunfish were also stocked.

The fish population of this stream was sampled with electrofishing gear in 1977, 1978, and 1980. No redbreast sunfish were taken during the 1977 study (Jones 1979). One 6-in redbreast sunfish was taken during a 40-minute sampling period in 1978 for a rate of 1.5 redbreast sunfish per hour. This fish represented 1.3% of the fish

population sampled (Table 3). In 1980, four 4-in redbreast sunfish were taken during a 30-minute period, which is a rate of 8 redbreast sunfish per hour. This species represented 4.8% of the total fish population sampled (Table 4).

Rod and reel sampling of this stream on 10 July 1980 resulted in a catch rate of 1.8 fish/hour, as nine fish were taken during 5 hours of fishing. Six redbreast sunfish (two harvestable size) were creeled for a catch rate of 1.2 redbreast sunfish per hour (Table 5).

Straight Creek

Straight Creek was stocked with redbreast sunfish in 1974-1976. In 1978, 12 redbreast sunfish (2-6 in long) were taken during a 20-minute sampling period for a capture rate of 36 fish/hour. Redbreast sunfish represented 13.3% of the fish population sampled (Table 6). Redbreast sunfish made up 55% of the harvestable-size fish taken in this study.

Indian Creek

Redbreast sunfish were stocked in Indian Creek in 1976-1978. The catch rate of redbreast sunfish from electrofishing was from 1 fish/hour in 1979 to 14 fish/hour in 1980 (Tables 7 and 8). Redbreast sunfish represented 56% of the fish population during 1980; seven of the nine redbreast sunfish taken were harvestable size (6 in or longer).

Project personnel spent 6.66 hours fishing with rod and reel on Indian Creek in May and June 1980. Six redbreast sunfish were creeled that ranged in length from 4 to 9 in. The catch rate for

redbreast sunfish averaged 0.91 fish/hour during these surveys (Tables 9 and 10). The catch rate for all species taken was 2.73 fish/hour.

Watts Creek

Redbreast sunfish were stocked in Watts Creek in 1977-1979. Also, it is highly possible redbreast sunfish were inadvertently stocked in this stream in 1969 since the hatchery where they were reared that year was located on this watershed. The fish population of this stream was sampled with electrofishing gear in 1979, 1980, and 1984 (Tables 11, 12, and 13). Redbreast sunfish represented 4% and 2% of the fish population in 1979 and 1980, respectively. Studies in 1984 revealed that redbreast sunfish made up 13% of the fish population.

Cursory creel surveys by project personnel indicated that a large part of the fishery on this stream was redbreast sunfish.

Clear Fork

Clear Fork was stocked with redbreast sunfish in 1979 and 1981. Electrofishing studies were conducted on this stream in 1982 and 1983. Redbreast sunfish were not recovered during these studies (Tables 14 and 15).

Age and Growth Studies

Results of age and growth studies on five streams in the Upper Cumberland River drainage indicated that redbreast sunfish grew to a length of between 2.05 and 2.90 in at age 1, 3.20 to 4.50 in at age 2, 4.00 to 5.80 in at age 3, 5.60 to 6.80 in at age 4, and 6.30 in at age 5 (Table 16).

Physical-Chemical Studies

The physical-chemical characteristics were well within

established criteria for suitable redbreast sunfish habitat in all the study streams where redbreast had been stocked (Table 17).

Eastern Fishery District

Greasy Creek

A 3-year stocking of redbreast sunfish was completed in 1981. Follow-up studies to determine survival were planned for 1982, but were not conducted due to poor water conditions. Studies planned for 1983 were also curtailed for the same reasons. Sampling in 1984, however, was accomplished.

A total of three study sites, pools which exhibited possible redbreast sunfish habitat, were located in the lower section of Greasy Creek. Study sites ranged from 2.1 to 3.0 mi upstream from the mouth of Greasy Creek where it flows into the Middle Fork of the Kentucky River. These pools were the only areas accessible with a four-wheel drive vehicle and an electrofishing boat. Electrofishing time was 0.5 hour at each pool for a total of 1.5 hours of diurnal electrofishing. All three sites were similar in physical and chemical characteristics (Table 18). Pools were typically 300 ft in length, averaged about 70 ft in width, and ranged from 1.7 to 2.9 ft in average depth. All pools had adequate fish shelter composed of boulders, undercut banks, logs, and brush. All chemical analyses were considered in the acceptable range, though the pH and alkalinity levels were somewhat elevated.

A total of 15 fish species were collected compared to 20 in 1971 (Jones et al. 1973) when chemical sampling was done. Studies in the late 1950's (Turner et al. 1959) produced as many, if not more. Exact numbers could not be determined as all "forage" fish such as

minnows, shiners, and darters were combined and not specified as to species. Turner also used electrofishing gear for sampling. The obvious absence of some species recorded earlier could have been due to degraded water quality. This may also be a factor affecting the survival of redbreast sunfish. Though two native panfish species were collected during the recent studies, no redbreast sunfish were observed (Tables 19-21). Causes for their absence may be due to sediments on the stream bed, an average of 0.3 ft of sediment not compacted, and high turbidity. It may also be possible that populations do exist in other sections of the stream, but not very likely. Conversations with the local conservation officer, however, revealed that no fish were known to have been creelied by fishermen (Billy Joe Napier personal communication 1984). The number of fish collected from pool no. 1 totaled 75, 71 in pool no. 2, and 56 in pool no. 3 for capture rates of 150 fish/hour, 142 fish/hour, and 112 fish/hour, respectively. Game fishes were not numerous; they were represented by spotted bass (Micropterus punctulatus) and smallmouth bass (M. dolomieu), with the former species slightly edging out the latter. Food fishes were represented by channel catfish and flathead catfish, with channel catfish exhibiting a fair to good population. Panfishes collected were rock bass (Ambloplites rupestris) and longear sunfish. Longear sunfish were most dominant and showed no sign of hybridization with other panfish. Longnose gar was the only representative species of the predatory group, with these being present only in the upper study pool. Commercial fishes were represented by three species: golden redhorse, black redhorse, and northern hog sucker. Golden redhorse were the most abundant of this group of fish. Forage species included logperch

(Percina caprodes), blackside darter (P. maculata), silver shiner (Notropis photogenis), striped shiner (N. chrysocephalus), and spotfin shiner (N. spilopterus). It may be noted that these species are typically pool inhabitants. Other species may be present in the riffle areas. These areas were not sampled at the time of electrofishing. In previous studies done by Prather (1985) and Jones (1984) in the upper Kentucky River tributaries - North Fork, Middle Fork, and South Fork, three of the more abundant species were golden redhorse, longear sunfish, and spotted bass.

CONCLUSIONS

Northwestern Fishery District

Fishable populations of redbreast sunfish were not established in Cypress Creek despite a rather intensive stocking effort. Water quality at Cypress Creek was undergoing a rather marked recovery period immediately prior to and during the stocking effort due to the closing of one large strip mine in the watershed and reclamation efforts throughout the watershed. Population studies, both chemical and hook-and-line, revealed good populations of black bass and panfish species. Water quality determinations in July 1980 revealed no degradation from acidic-laden waters. This combination of improved water quality and concurrent native fish population improvement was thought to be responsible for the inability of redbreast sunfish to establish a population. Although the redbreast sunfish failed to become established, native fish populations in this stream have rebounded to such a point that the upper Cypress Creek area has become known as an excellent black bass and panfish fishing area. It is

seldom that one can look at a stocking failure and be satisfied; however, the environmental awareness and subsequent passage of strip mine reclamation laws have resulted in Cypress Creek having native fish population far in excess of anything we could have hoped to achieve by our redbreast sunfish stocking efforts.

Southeastern Fishery District

Redbreast sunfish populations have been established in Jellico Creek, Straight Creek, Indian Creek, and in upper Watts Creek, thereby providing an additional, desirable panfish for anglers at these streams. These streams now bring the total number of streams in Kentucky with an established redbreast sunfish population to seven (Figure 1). The other three streams are Brownies Creek (Bell County), Clear Creek (Bell County), and Marsh Creek (McCreary County).

Eastern Fishery District

Redbreast sunfish were stocked in Greasy Creek in order to provide a fishery in this stream impacted primarily by mining activities. Greasy Creek is periodically subjected to acid water, coal fines, and high turbidity which are a direct result of increased deep-mining practices in the drainage. Redbreast sunfish are, in fact, able to tolerate somewhat acidic pH levels. Lower pH levels occur periodically in Greasy Creek in the form of "slugs" of water released from deep-mining activities. During sampling, however, higher pH levels were observed. Habitat suitable for redbreast sunfish was evidently not present due to certain physical and chemical conditions in Greasy Creek. Physically, the stream has low to moderate fish shelter composed mainly of boulders and rocks. Redbreast sunfish populations were not established in sampling stations located in Greasy

Creek. Stocking of larger fish may allow better survival of stocked fish, but will probably not result in the establishment of a population due to high turbidity and a high sediment load on the stream bottom.

RECOMMENDATIONS

Northwestern Fishery District

Redbreast sunfish should be considered for stocking in those streams with known, long-term, water quality problems due to low pH levels. Such areas still exist in Western Kentucky as a result of pre-reclamation strip-mining and shaft-mining. As these streams become apparent through subsequent stream survey research, they should be individually assessed as to their degree of degradation and potential for redbreast sunfish stockings. Efforts should always be directed first at alleviating the source of the pollution problem. With hindsight, it is apparent that the stocking of redbreast sunfish into Cypress Creek was unnecessary; however, the improved water quality and fish populations at Cypress Creek were not anticipated.

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Southeastern Fishery District

The late Mr. James P. Carter, who later served as Assistant

Director and Dingell-Johnson Coordinator for the Division of Fisheries, instituted the stocking program of redbreast sunfish in Kentucky streams.

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Eastern Fishery District

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LITERATURE CITED

- Carlander, Kenneth D. 1977. Handbook of freshwater fishery biology. Volume 2. Iowa State University Press, Ames, Iowa, USA.
- Carter, J.P. and A.R. Jones. 1969. Inventory and classification of streams in the upper Cumberland River drainage. Fisheries Bulletin 52, Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky, USA.
- Everhart, H.W. and W.D. Youngs. 1981. Principles of fishery science,

second edition. Comstock Publishing Associates, Cornell University Press, Ithaca, New York, USA.

- Jones, Albert R. 1973. Inventory and classification of streams in the Kentucky River drainage. Fisheries Bulletin 56, Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky, USA.
- Jones, A.R. 1979. Evaluation of redbreast sunfish Lepomis auritus stocking in selected streams in southeastern Kentucky. Special Fisheries Report 2. Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky, USA.
- Lagler, K.F. 1956. Freshwater fisheries biology, second edition. William C. Brown Company, Dubuque, Iowa, USA.
- Michaels, R., G.F. Germann, and D.R. Holder. 1981. Age group and size class composition, survival and exploitation rate of redbreast sunfish in the Satilla River. Georgia Department of Natural Resources, Atlanta, Georgia, USA.
- Phillips, H.A. 1968. Management of the redbreast in North Carolina waters, reproduction of the redbreast sunfish. Federal Aid Project F-16, Final Report, North Carolina Wildlife Resources Commission, Raleigh, North Carolina, USA.
- Phillips, H.A. and E.H. Shannon. 1967. Management of the redbreast sunfish in North Carolina Waters. Federal Project F-16, Annual Progress Report, North Carolina Wildlife Resources Commission, Raleigh, North Carolina, USA.
- Shannon, E.E. 1966. Geographic distribution and habitat requirements of the redbreast sunfish Lepomis auritus in North Carolina. North Carolina Wildlife Resources Commission, Raleigh, North Carolina, USA.
- Turner, W.R. 1959. Pre-impoundment surveys of six Kentucky streams. Kentucky Fisheries Bulletin 24, Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky, USA.

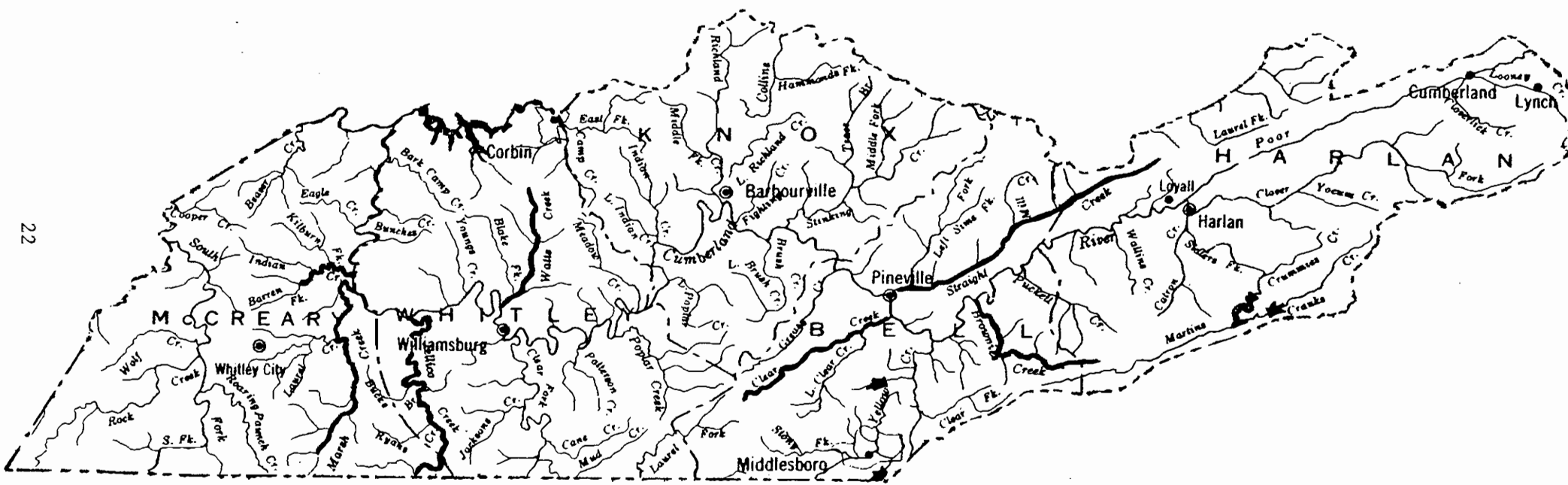


Figure 1. Streams (darkened lines) in Kentucky that now have an established population of redbreast sunfish.

Table 1. Physical, chemical, and biological characteristics of Cypress Creek on 18 July 1980.

Study area data

Location: 0.25 mile below Hwy. 81 bridge near South Carrollton (Muhlenburg County)	Length of sample area: 200 ft Average width: 28 ft Average depth: 2.6 ft Sample acreage: 0.13
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Method of sampling: 1.0 ppm 5% emulsifiable rotenone.

Physical and chemical parameters

pH: 7.2
 Total alkalinity: 145 mg/l
 Temperature (H₂O): 84F
 Stream flow: 2 4.6 cfs
 Secchi disk: 14 in
 Gradient: 2.9 ft/mi
 Bottom type: leaf litter, silt, detritus
 Fish shelter: abundant - logs, brush,
 beaver dams
 Shade: 80%
 Aquatic vegetation: buttonbrush

Fish fauna (F - I - H)

Largemouth bass	2 - 8 - 2
Grass pickerel	2 - 1 - 0
Bowfin	0 - 1 - 1
Bluegill	16 -17 -12
Green sunfish	1 - 0 - 0
Longear sunfish	26 -27 - 4
Flier	0 - 0 - 2
Warmouth	12 -12 - 2
Yellow bullhead	1 - 3 - 0
Gizzard shad	0 - 6 - 7
Pirate perch	10 - 1 - 0
Golden shiner	1 - 1 - 0
Blackstripe topminnow	3 - 0 - 0
Mud darter	3 - 0 - 0
Blackside darter	1 - 0 - 0
Gambusia	12 - 0 - 0
Banded pygmy sunfish	3 - 0 - 0

Table 2. Stocking records for redbreast sunfish in southeastern Kentucky streams.

	Size (in)	Year	Number stocked
Brownies Creek	2-4	1969	2,500
	2-5	1971	1,925
	1	1972	50,000
Clear Fork	2-4	1969	2,500
	1-4	1971	1,650
	1	1972	25,700
Indian Creek	1-4	1976	32,500
	2	1977	11,500
	1-2	1978	15,860
Jellico Creek	1-4	1969	250
	1-2	1974	20,000
	1-3	1975	50,000
	1-4	1976	32,500
Marsh Creek	1-4	1969	2,000
	1	1971	84,000
Straight Creek	1-2	1974	20,000
	1-3	1975	50,000
	1-4	1976	50,000
Watts Creek	2	1977	11,500
	1-2	1978	15,810
	2	1979	26,000
Clear Fork River	1-2	1979	85,500
	Fry	1981	10,000
	2	1981	60,000

Table 3. Electrofishing study results on Jellico Creek on 6 November 1978.

Species	Inch group							Total	Fish per hour
	2	3	4	5	6	7	8		
Redbreast sunfish					1			1	1.5
Bluegill			1					1	1.5
Longear sunfish		2	1					3	4.5
Smallmouth bass						2		2	3.0
Spotted bass		1			1			2	3.0
Rock bass			1		1			2	3.0
Flathead catfish		1						1	1.5
Northern hog sucker	1						2	3	4.5
Creek chub	3	1			1	1		6	9.0
Roseyface shiner	12	5						17	26.0
Spotfin shiner	1	3	4	1				9	15.0
Central stoneroller			2					2	3.0
Bluntnose minnow	14			3				17	26.0
Arrow darter		3						3	4.5
Blackside darter	3							3	4.5
Greenside darter		1						1	1.5
Rainbow darter	2							2	3.0
Total								75	

Table 4. Electrofishing results on Jellico Creek on 8 October 1980.

Species	Inch group								Total	Fish per hour
	1	2	3	4	5	6	7	8		
Redbreast sunfish				4					4	8.0
Bluegill	3			3					6	12.0
Longear sunfish				2					2	4.0
Spotted bass			2	5	1				8	16.0
Rock bass					2	1			3	6.0
Yellow bullhead							1		1	2.0
Northern hog sucker			4						4	8.0
Logperch			1						1	2.0
Creek chub					5	2	2	1	10	20.0
Central stoneroller		4	3	1	1				9	18.0
Bluntnose minnow	14	16	5						35	70.0
Total									83	

Table 5. Redbreast sunfish survey by rod and reel in the middle section of Jellico Creek on 10 June 1980.

Species	No. creeled	Length (in)	Hours fished
Redbreast sunfish	2	4	5
Redbreast sunfish	2	5	
Redbreast sunfish	2	7	
Longear sunfish	1	5	
Creek chub	2	4	
Total	9		5

Table 6. Electrofishing study results on Straight Creek on 2 November 1978.

Species	Inch group										Total	Fish per hour
	2	3	4	5	6	7	8	9	10	11		
Redbreast sunfish	1	2	3	1	5						12	36.0
Longear sunfish		7									7	21.0
Hybrid sunfish			1								1	3.0
Smallmouth bass							1			1	2	6.0
Spotted bass	2		1	2					1		6	18.0
Rock bass					2	1	1				4	12.0
Northern hog sucker				2	1	2	2				7	21.0
Golden redhorse		7			3			1			11	33.0
Common shiner		2	6								8	24.0
Rosyface shiner 17		3									20	60.0
Central stoneroller			1								1	3.0
Bluntnose minnow	6	4									10	30.0
Silverjaw minnow	1										1	3.0
Total											90	

Table 7. Electrofishing study results on Indian Creek on 6 December 1979.

Species	Inch group						Total	Fish per hour
	2	3	4	6	7	8		
Redbreast Sunfish						1	1	1.0
Longear sunfish			1		1		2	3.0
Rock bass				1		1	2	3.0
Fantail darter		1					1	1.0
Total							6	

Table 8. Electrofishing study results on Indian Creek on 8 October 1980.

Species	Inch group							Total	Fish per hour
	3	4	5	6	7	8	10		
Redbreast sunfish		2		3	4			9	14.0
Longear sunfish	1							1	2.0
Smallmouth bass				1		1		2	3.0
Rock bass		1	1				1	3	5.0
Northern hog sucker						1		1	2.0
Total								16	

Table 9. Redbreast sunfish survey by rod and reel on Indian Creek on 29 May 1980.

Species	No.	Length (in)	Section of stream	Hours fished
Redbreast sunfish	2	4	Upper	3
Redbreast sunfish	1	5	Middle	2
Redbreast sunfish	1	6	Upper	
Rock bass	3	6	Middle	
Rock bass	2	7	Upper	
Rock bass	1	10	Upper	
Smallmouth bass	1	6	Upper	
Smallmouth bass	1	9	Upper	
Total	12			5

Table 10. Redbreast sunfish survey by rod and reel in the middle section of Indian Creek on 9 July 1980.

Species	No.	Length (in)	Hours/minutes fished
Redbreast sunfish	1	9	1:40
Redbreast sunfish	1	7	
Rock bass	1	6	
Smallmouth bass	1	11	
Smallmouth bass	1	9	
Smallmouth bass	1	5	
Total	6		1:40

Table 11. Electrofishing study results on Watts Creek on 4 December 1979.

Species	Inch group										Total	Fish per hour	
	2	3	4	5	6	7	8	9	10	12			
Redbreast sunfish						2						2	6.0
Bluegill		1										1	3.0
Longear sunfish		1										1	3.0
Green sunfish			1	1								2	6.0
Rock bass							2					2	6.0
Northern hog sucker			1		3	3	2	3	1	1		14	42.0
Creek chub			4	2	10							16	48.0
Bluntnose minnow	5	1										6	18.0
Fantail darter	1											1	3.0
Total											45		

Table 12. Electrofishing study results on Watts Creek on 20 November 1980.

Species	Inch group					Total	Fish per hour
	2	3	4	5	7		
Redbreast sunfish					1	1	3.0
Longear sunfish				1		1	3.0
Northern hog sucker	5	3				8	24.0
Creek chub			3	2		5	15.0
Emerald shiner	9	6				15	45.0
Bluntnose minnow	9	2				11	33.0
Fathead minnow			1			1	3.0
Greenside darter	1					1	3.0
Total						43	

Table 13. Electrofishing study results on Watts Creek on 16 October 1984.

Species	Inch group								Total	Fish per hour
	1	2	3	4	5	6	7	8		
Redbreast sunfish		3	6	1	2				12	24.0
Rock bass			2						2	4.0
Green sunfish	4	17	15	5	1				42	84.0
Northern hog sucker					1			1	2	4.0
Creek chub		2	3						5	10.0
Emerald shiner			3						3	6.0
Striped shiner		1							1	2.0
Spotfin shiner			1	8	1				10	20.0
Central stoneroller			1	1	1	1	1		5	10.0
Bluntnose minnow		1	4						5	10.0
Rainbow darter		2							2	4.0
Total									89	

Table 14. Electrofishing study results on Clear Fork on 10 November 1982.

Species				Total	Fish per hour
	3	7	10		
Spotted bass		1		1	1.5
Rock bass			1	1	1.5
White crappie		1		1	1.5
Northern hog sucker	1			1	1.5
Emerald shiner	1			1	1.5
Total				5	

Table 15. Electrofishing study results on Clear Fork on 14 November 1983.

Species	Inch group				Total	Fish per hour
	2	3	6	7		
Spotted bass	1	1			2	4.0
Northern hog sucker			1		1	2.0
Emerald shiner	12	15			27	54.0
Central stoneroller			2	1	3	6.0
Bluntnose minnow	21	8			29	58.0
Total					62	

Table 16. Mean annual length (in) of redbreast sunfish captured at five streams in the Upper Cumberland River drainage from 1976-1984.

Stream	No. of fish	Age				
		1	2	3	4	5
Brownies Creek	10	2.67	4.15	5.58	6.79	
Clear Fork	10	2.05	3.20	3.98	5.57	6.30
Indian Creek	10	2.87	4.50	5.71	6.68	
Straight Creek	11	2.20	3.63	4.93	5.90	
Watts Creek	7	2.55	4.16	5.82	6.49	

Table 17. Physical and chemical characteristics at Clear Fork, Indian Creek, Watts Creek, and Jellico Creek.

Stream (date)	Temperature (F)	Dissolved oxygen (ppm)	pH	Total alkalinity (ppm)	Turbidity (NTU)	Salinity (ppt)	Specific conductance (umhos/cm)
<u>Clear Fork</u>							
06-02-80	70.7	7.9	8.5	22			
10-09-80	55.0	7.3		40			
10-06-81	61.3	8.5		69			
11-10-82	46.4	11.0	7.6	58		0	197
11-14-83	46.4	9.8	7.0	68	7.2	0	370
<u>Indian Creek</u>							
12-06-79			7.5	7			
05-29-80	70.0	9.3	7.9	9			
10-08-80	56.0	9.4		10			
10-06-81	56.3	9.6		13			
10-18-84	62.6	6.7	5.9	20.5	16.5	0	110
<u>Watts Creek</u>							
12-04-79	33.0		7.8	40			
11-20-80	41.0	12.2		53			
10-06-81	60.0	7.9		75			
11-09-82	46.4	12.0	7.3	55		0	220
06-21-83	69.8		7.9	231	7.0	0	390
10-16-84	63.5	8.3	6.0	86	4.0	0	410
<u>Jellico Creek</u>							
11-06-78 (middle)			7.0	56			
11-06-78 (lower)			6.9	28			
10-08-80	56.0	7.4		39			
<u>Straight Creek</u>							
11-02-78			6.9	46			

Table 18. Description of sampling stations during redbreast sunfish studies at Greasy Creek in Leslie County, Kentucky in 1984.

Station	Location	Order	Pool length (ft)	Mean width (ft)	Mean depth (ft)	Surface acres	Maximum depth (ft)	Dissolved oxygen (mg/l)	pH	Total alkalinity (mg/l)	Salinity (ppt)	Specific conductivity (umhos/cm)	Turbidity (NTU)	Current velocity (ft/sec)	Water temperature (F)
1	Access road 2.1 miles from junction of Hwy. 2009 and US 421 (mouth)	IV	300	65.0	1.7	0.45	3.4	8.4	8.9	68.4	0	270	6	0.05	82
2	2.4 miles upstream from mouth	IV	280	78.2	2.9	0.50	9.5	8.4	8.9	68.4	0	270	6	nil	84
3	3.0 miles upstream from mouth	IV	300	78.4	2.3	0.54	10.0	8.4	8.9	68.4	0	270	6	nil	84

Table 19. List of fish species collected from Station 1 at Greasy Creek on 13 June 1984 after 0.5 hour of diurnal electrofishing.

Species	Inch group														Total	Fish per hour
	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Smallmouth bass		1		1											2	4.0
Spotted bass		1		1											2	4.0
Channel catfish						5		1	1			1	1	1	10	20.0
Flathead catfish								1		1	1				3	6.0
Longear sunfish			2	2											4	8.0
Golden redhorse		1	4		9	4	1	4	6	4	4	1	1		39	78.0
Black redhorse				2	1	1			1			1			6	12.0
Northern hog sucker					1			1	1						3	6.0
Logperch		2													2	4.0
Blackside darter	1	3													4	4.0
Total															75	150.0

Table 20. List of fish species collected from Station 2 at Greasy Creek on 13 June 1984 after 0.5 hour of diurnal electrofishing.

Species	Inch group													Total	Fish per hour	
	2	3	4	5	6	7	8	9	10	11	12	16	21			
Smallmouth bass			1			1			1						3	6.0
Spotted bass		1		1			1								3	6.0
Channel catfish							1	1	6	3		1	1		13	26.0
Longear sunfish	1	1	2	4	1										9	18.0
Rock bass				1											1	2.0
Golden redhorse			2	3	6	2	1	5	3		2				24	48.0
Northern hog sucker								1							1	2.0
Blackside darter		3													3	6.0
Striped shiner				3											3	6.0
Spotfin shiner		5	1												6	12.0
Silver shiner		5													5	10.0
Total															71	142.0

Table 21. List of fish species collected from Station 3 at Greasy Creek on 13 June 1984 after 0.5 hour of diurnal electrofishing.

Species	Inch group																Total	Fish per hour		
	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18	21			22	
Spotted bass		2	1															3	6.0	
Channel catfish							1	1	2	2			1	1		1	1	10	20.0	
Flathead catfish													1					1	2.0	
Lognose gar															1	2	1	3	7	14.0
Rock bass				1														1	2.0	
Longear sunfish			1															1	2.0	
Golden redhorse			3	5	2		3	5	2	5	1							26	52.0	
Black redhorse								1										1	2.0	
Northern hog sucker						1		1										2	4.0	
Blackside darter	2																	2	4.0	
Logperch	1																	1	2.0	
Silver shiner		1																1	2.0	
Total																		56	112.0	